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PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

In re application of:
Radoslaw Romuald ZAKRZEWSKI

Appln. No.: 10/803,872 **Art Unit:** 2129

Filed: March 18, 2004 **Examiner:** Peter D. COUGHLAN

For: **METHOD AND APPARATUS FOR RANDOMIZED VERIFICATION OF NEURAL NETS** **Docket No.:** BFM-02801

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Name: Sandra Pires

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Applicant hereby submits the originally-signed Appeal Brief with Certificate of Mailing, and postcard receipt for the above-referenced patent application. Please charge the amount of $510.00 for the appeal brief fee to our credit card. Form PTO-2038 is attached.

Although we believe that we have appropriately provided for any fees due in connection with this submission, the Commissioner is authorized to credit any overpayment or charge any deficiencies to/from our **Deposit Account No. 503596**. Two originally-executed copies of this form are being submitted.

Should there be any questions after reviewing this paper, the Examiner is invited to contact the undersigned at 508-898-8603.

Respectfully submitted,
MUIRHEAD AND SATURNELLI, LLC

Donald W. Muirhead
Reg. No. 33,978

June 9, 2008
Date

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Sandra Pires

* * * * *

APPEAL BRIEF UNDER 37 C.F.R. § 41.37

Application Serial No.: 10/803,872

Filed: March 18, 2004

Applicant/Appellant: Radoslaw R. ZAKRZEWSKI

Title: METHOD AND APPARATUS FOR RANDOMIZED VERIFICATION OF NEURAL NETS

Appeal from a decision of the Primary Examiner dated February 1, 2008

Atty. Docket: BFM-02801

REAL PARTY IN INTEREST

The above-identified application is assigned to Simmonds Precision Products, Inc. by virtue of an Assignment recorded by the U.S. Patent and Trademark Office on June 10, 2004, at Reel 015451 / Frame 0189.

RELATED APPEALS AND INTERFERENCES

Appellant is not aware of any other appeals or interferences related to the above identified application.

STATUS OF CLAIMS

This is an appeal from a decision of the Primary Examiner in the Final Office Action dated February 1, 2008, finally rejecting claims 1-36 in the above identified patent application, and claims 1-36 are on appeal. Claims 1-36 stand rejected under 35 U.S.C. 101 as being directed to non-statutory subject matter. Claims 1, 16-19, 34-36 stand rejected under 35 U.S.C. 101 as lacking patentable utility. Claims 12 and 30 stand rejected under 35 U.S.C. 112, first paragraph, as lacking enablement. No claim has been allowed. Appellant appeals the above-noted rejections. A Notice of Appeal was submitted on April 9, 2008, with a Request for Pre-Appeal Brief Review. A Notice of Decision on Pre-Appeal Brief Review was mailed on April 25, 2008, indicating the case should proceed to the Board of Patent Appeals and Interferences and requiring submission of an Appeal Brief.

STATUS OF AMENDMENTS

Appellant submitted an Amendment and Response on November 9, 2007 in response to the non-final Office Action dated August 9, 2007 in which claim amendments were made and accordingly entered by the Examiner. Appellant filed a Notice of Appeal and Requested for Pre-Appeal Brief Review on April 9, 2008, in response to the Final Office Action dated February 1, 2008, in which no claim amendments were proposed. Accordingly, all proposed claim amendments have been appropriately entered in the above-captioned application. The claims involved in this Appeal are set forth in the attached Claims Appendix.

SUMMARY OF CLAIMED SUBJECT MATTER

I. Background

Appellant discloses that a component, such as a neural net, may be provided by a simulation model of an aircraft subsystem. The model may be an approximation of the actual physical system and may introduce a degree of error or uncertainty. The approximation error between the system and the model may rarely be assessed with certainty and may be expressed in probabilistic terms. Thus, even if an algorithm is deterministically verified against a system model, there may remain a statistical uncertainty regarding validity of such result, which suggests that the use of a deterministic approach to verification may not be suitable. (See, for example, page 36, lines 1-21 and page 44, lines 1-22 of the originally-filed specification.) Appellant's presently-claimed invention, as discussed in detail below, provides for randomized verification of the accuracy of a component implemented from a model based on using test points for a test of the component that are randomly selected.

(See, for example, page 43, lines 7-22 of the originally-filed specification). Appellant has found that a randomized verification method may be applicable to a much wider spectrum of practical problems than previously developed for the deterministic verification approach. (See, for example, page 47, line 11 to page 48, line 11 of the originally-filed specification.)

II. Appellant's Claimed Invention

Appellant's independent claims are discussed below in connection with the specification and figures for purposes of example and explanation only in accordance with 37 C.F.R. 41.37(c)(v).

Independent claim 1 recites a method for verifying accuracy of a component that is implemented from a model including receiving a number of randomly selected samples, M, that result from at least one test of the component, for $M \geq \frac{1}{\varepsilon}\ln\left(\frac{1}{\delta}\right)$ (*see,* for example, Equation 9 on page 21 and page 34, line 6 to page 35, line 6 of the originally filed specification; *see also* FIG. 3), wherein δ represents a confidence value in the range $0 < \delta < 1$, ε represents an accuracy level of p-est to its true value p, in the range $0 < \varepsilon < 1$, p represents a probability that a randomly selected point is in accordance with a selected criterion, F, p-est, an estimate of p based on the M randomly selected samples, is zero, and a probability that ($p \geq \varepsilon$) is equal to or less than δ. (*See*, for example, page 21, line 22 to page 24, line 2 of the originally-filed specification.) For each of the randomly selected samples, it is determined whether each sample is not in accordance with said selected criterion, F. The accuracy of the component is then verified based on the determining. (*See*, for example,

FIG. 1 and page 48, line 16 to page 49, line 17 of the originally filed specification.) Claims 2-11 depend directly or indirectly from independent claim 1.

Independent claim 12 recites a method for determining a number of randomly selected data values for verification of a component that is implemented from a model including receiving a value of zero for p-est, an estimate of p based on a random sample, p representing a probability that a randomly selected data value is in accordance with a selected criterion, F. (*See,* for example, Equation 9 on page 21 and page 34, line 6 to page 35, line 6 of the originally filed specification; *see also* FIG. 3). The method includes receiving δ representing a confidence value in the range $0< \delta< 1$. The method includes receiving ε representing an accuracy level of p-est to its true value p, in the range $0< \varepsilon < 1$, wherein a probability that $(p \geq \varepsilon)$ is equal to or less than δ. (*See*, for example, page 21, line 22 to page 24, line 2 of the originally-filed specification.) The method includes determining said number of randomly selected data values, M, that result from at least one test of the component and are used for verification of the component wherein M is determined in accordance with p-est=0, δ, and ε. (See, for example, FIG. 1 and page 48, line 16 to page 49, line 17 of the originally filed specification.) Claims 13-18 depend directly or indirectly from independent claim 12.

Independent claim 19 recites a computer program product, stored on a computer-readable medium, that verifies accuracy of a component that is implemented from a model, the computer program product comprising code that receives a number of randomly selected samples, M, that result from at least one test of the component, for $M \geq \frac{1}{\varepsilon}\ln\left(\frac{1}{\delta}\right)$ (*see,* for

example, Equation 9 on page 21 and page 34, line 6 to page 35, line 6 of the originally filed specification; *see also* FIG. 3), wherein δ represents a confidence value in the range $0 < \delta < 1$, ε represents an accuracy level of p-est to its true value p, in the range $0 < \varepsilon < 1$, p represents a probability that a randomly selected point is in accordance with a selected criterion, F, p-est, an estimate of p based on M randomly selected samples, is zero, and a probability that $(p \geq \varepsilon)$ is equal to or less than δ. (*See*, for example, page 21, line 22 to page 24, line 2 of the originally-filed specification.) It is determined if each of said randomly selected samples is not in accordance with said selected criterion, F. Accuracy of the component is verified based on whether each of said randomly selected samples is in not in accordance with said selected criterion F. (*See*, for example, FIG. 1 and page 48, line 16 to page 49, line 17 of the originally filed specification.) Claims 20-29 depend directly or indirectly from independent claim 19.

Independent claim 30 recites a computer program product, stored on a computer-readable medium, that determines a number of randomly selected data values for verification of a component that is implemented from a model, the computer program product comprising code that receives a value of zero for p-est, an estimate of a probability p based on a random sample, p representing a probability that a randomly selected data value is in accordance with a selected criterion, F. (*See,* for example, Equation 9 on page 21 and page 34, line 6 to page 35, line 6 of the originally filed specification; *see also* FIG. 3). Code is included that receives δ representing a confidence value in the range $0< \delta< 1$. Code is included that receives ε representing an accuracy level of p-est to its true value p, in the range $0< \varepsilon < 1$, wherein a probability that $(p \geq \varepsilon)$ is equal to or less than δ. (*See*, for example, page 21, line

22 to page 24, line 2 of the originally-filed specification.) Code is included that determines said number of randomly selected data values, M, that result from at least one test of the component and are used for verification of the component, wherein M is determined in accordance with p-est=0, δ, and ε. (*See*, for example, FIG. 1 and page 48, line 16 to page 49, line 17 of the originally filed specification.) Claims 31-36 depend directly or indirectly from independent claim 30.

GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

I. Claims 1-36 stand rejected under 35 U.S.C. 101 as being directed to non-statutorily patentable subject matter.

II. Claims 1, 16-19, 34-36 stand rejected under 35 U.S.C. 101 as lacking patentable utility.

III. Claims 12 and 30 stand rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the enablement requirement.

ARGUMENT

I. <u>The Examiner has failed to establish a prima-facie argument that claims 1-36 are directed to non-statutorily patentable subject matter under 35 U.S.C. §101 or lacking patentable utility thereunder.</u>

A. <u>Standard for Patentability Under 35 U.S.C. 101</u>

Under 35 U.S.C. 101, patentable subject matter must belong to at least one of four patentable categories: process, machine, manufacture, and composition of matter. *See In re Nuijten*, 500 F.3d 1346 (Fed. Cir. 2007). A claim reciting an algorithm or abstract idea can state statutory subject matter only if, as employed in the process, it is embodied in, operates on, transforms, or otherwise involves another class of statutory subject matter, i.e., a machine, manufacture, or composition of matter. *In re Comiskey*, 499 F.3d 1365 (Fed. Cir. 2007). Further, a claimed invention, as a whole, must be useful and accomplish a practical application that produces a "useful, concrete and tangible result." *See, e.g., AT&T Corp. v. Excel Communications, Inc.*, 172 F.3d 1352 (Fed. Cir. 1999). A claim may not wholly pre-empt a mathematical formula so as to be, in practical effect, a patent on the formula itself. *State Street Bank & Trust Co. v. Signature Financial Group Inc.*, 149 F.3d 1368, 47 USPQ2d 1596, (Fed. Cir. 1998). In evaluating whether a claim meets the requirements of section 101, the claim must be considered as a whole to determine whether it is for a particular application of an abstract idea, natural phenomenon, or law of nature, and not for the abstract idea, natural phenomenon, or law of nature itself. *See Id.* Transformation and reduction of an

article "to a different state or thing" indicates the patentability under 35 U.S.C. 101 of a process claim. *Gottschalk v. Benson*, 409 U.S. 63 (1972).

B. The Examiner's conclusions that Appellant's claims are directed to non-statutorily patentable subject matter under 35 U.S.C. 101, or lacking patentable utility thereunder, have been made in error.

The system of the presently-claimed invention provides for randomized verification of components, such as neural networks. As one example in the specification, Appellant discloses that a component, such as a neural net, may be provided by a simulation model of an aircraft subsystem. The model may be an approximation of the actual physical system and may introduce a degree of error or uncertainty. The approximation error between the system and the model may rarely be assessed with certainty and may be expressed in probabilistic terms. Thus, even if an algorithm is deterministically verified against a system model, there may remain a statistical uncertainty regarding validity of such result, which suggests that the use of a deterministic approach to verification may not be suitable. (See, for example, page 36, lines 1-21 and page 44, lines 1-22 of the originally-filed specification.) Appellant's presently-claimed invention provides for randomized verification of the accuracy of a component implemented from a model based on using test points for a test of the component that are randomly selected. (See, for example, page 43, lines 7-22 of the originally-filed specification). Appellant has found that a randomized verification method may be applicable to a much wider spectrum of practical problems than previously developed for the

deterministic verification approach. (See, for example, page 47, line 11 to page 48, line 11 of the originally-filed specification.)

The rejection of claims 1-36 under 35 U.S.C. 101 for non-statutorily patentable subject matter (and also to the extent this rejection is the basis for any rejection under 35 U.S.C. 112, first paragraph) is hereby traversed and reconsideration is respectfully requested. The Office Action concludes that determining accuracy of a component is not statutory and states that to be statutory under 35 U.S.C. 101, a claim must be directed to a practical application having a final result that is useful (specific, substantial and credible); concrete (substantially repeatable / non-unpredictable); and tangible (real world / non-abstract). Appellant recites that a component is implemented from a model, and the component is tested according to a randomized verification technique to verify accuracy according to criteria defined in the claim to verify whether the component is an accurate implementation of the model. A number of randomly selected samples is defined according to the recited features and the accuracy is verified according to a selected criterion. Appellant refers, for purposes of example and further explanation, to page 43, line 6 to page 45, line 2 of the originally-filed specification. Appellant submits that that the final result of the presently-claimed invention, for example, a component implemented from a model that is verified as accurate according to the recited criteria, is useful, concrete and tangible, as further discussed below.

The Examiner concludes that an invention that "verifies" has no practical application (top of page 4 of the Final Office Action). Appellant submits that this conclusion is

demonstrably incorrect. There is no exclusion of patentability under 35 U.S.C. 101 simply because a claimed invention is directed to a process of verification. Verification of accuracy of a component implemented from a model is a practical application. Specifically, following verification of accuracy of a component, the component is turned into a verified component, which is a different state of the component and which is a useful, concrete and tangible result. (See, for example, FIG. 2 and page 49, lines 19-24 of the originally-filed specification). For example, a practical application would be determining if a component has not been accurately implemented from a model of the component, in which case, for example, the component could be discarded or indicated as needing to be corrected. Further, the Office Action appears to actually suggest that the claimed invention has too many applications (see page 3 of the Office Action) in discussing "preemption" of Appellant's claims, stating on page 9 of the Office Action in question form whether the claimed invention would be suitable for a model of flight characteristics of an aircraft wing, a model of the spread of a disease throughout a country or a model of obesity among people of a given region. Appellant submits that if the same method steps, as recited by Appellant, are applied to determine whether a component generated from any of the above-noted models is accurately implemented from the model, then it is unclear why the Examiner considers that the method steps would not recite an invention having a practical application if applicable to all of the above-noted models.

Although the Examiner attempts to suggest that Appellant's claim invention "obtains preemption" because it can be directed to many models, Appellant submits that the practical application, recited by Appellant, is the verification of whether a component, implemented

from a model, is accurate to that model. Appellant describes a process for such verification and including mathematics-based steps for verifying the accuracy of the component implemented from the model. Specifically, the Examiner attempts to conclude that Appellant's claimed invention lacks a practical application because of its application to many models, but apparently fails to recognize that the final result of the claimed invention is verifying the accuracy of a component implemented from the model. That is, the Examiner's recitation (e.g., on page 3 of the Final Office Action) of many possible models to which the Appellant's claimed invention may be applied, fails to recognize that the practical application of the claimed invention is verifying if the component has been accurately implemented from the model. For example, Appellant refers to the discussion in the specification on page 43, lines 7-22 of the originally-filed specification. Appellant's claims are directed, not to a model, but to a result (component) implemented from that model, and specifically verification of the accuracy of that component. Accordingly, the claims produce a result tied to the physical world, the final result being useful, concrete and tangible, and that does not preempt a judicial exception, and thus the claims meet the statutory requirements of 35 U.S.C. 101.

Further, specifically with respect to Examiner's statement on page 9 of the Final Office Action that: "No example is provided which illustrates a practical application of the invention", Appellant directs particular attention to discussion in the specification, as noted above, concerning applicability of the claimed invention to an aircraft subsystem, for example (see page 44 of the originally-filed specification). Accordingly, in view of the above, Appellant submits that the rejection should be reversed.

The rejection of claims 1, 16-19, and 34-36 under 35 U.S.C. 101 as lacking patentable utility and the rejection of claims 1, 16-17, 19 and 34-35 on the same basis (and also to the extent this rejection is the basis for any rejection under 35 U.S.C. 112, first paragraph) are hereby traversed and it is respectfully requested that these rejections be reversed. The Office Action appears to object to the use of a confidence value (δ) that is between 0 and 1 and to the accuracy level (ε) being between 0 and 1, and the use of these variables in determining a number of randomly selected samples M in the equation $M \geq \frac{1}{\varepsilon}\ln\left(\frac{1}{\delta}\right)$. In the prior Office Action, the Examiner had concluded that the equation somehow indicates that "infinity is less than infinity which makes no sense." (see p. 4, August 9, 2007 Office Action.) Appellant submits that the above-noted confidence value (δ) and the accuracy level (ε) for the selection of randomly selected samples in the above-noted equation do not yield the conclusion "infinity is less than infinity" so as to be senseless. Instead, Appellant submits that in view of the above-noted equation, the values and limits correctly characterize the mathematical relationship for determining the number of randomly selected samples M, as further discussed below.

Rather than being "senseless", the equation for selecting the number of randomly selected samples M indicates that as the confidence value and accuracy level decrease in accordance with the recited features, the number of randomly selected samples required increases, based on the natural log of one divided by the confidence value and one over the accuracy level. The equation characterizes an analysis that the smaller the confidence value and more precise the level of accuracy desired, the higher the number of random samples

required, as dictated by the above-noted equation. Appellant submits there is no arbitrary cutoff as the confidence value (δ) and the accuracy level (ε) become smaller and smaller with respect to the number of randomly selected samples recited by the claimed invention in accordance with the recited bounds. Instead, the relationship between confidence value, accuracy level and number of randomly selected samples is accurately characterized by the equations, and defines patentable subject matter in conjunction with the other recited features. That is, if a very precise level of accuracy with a very narrow confidence interval is desired then many random samples will be required to achieve this. This is the relationship defined by the equation according to the variables therein. The Examiner's analysis of the equation appears somewhat flawed. Appellant submits that the recited features, specifically in connection with the equation for determining the minimum number of required samples for a desired confidence value and accuracy level, have utility and would be well understood by one of ordinary skill in the art.

Accordingly, in view of the above, Appellant respectfully requests that the rejections be reversed.

II. **<u>The Examiner has failed to establish a prima facie case that Appellant's claims fail to comply with 35 U.S.C. 112, first paragraph.</u>**

A. **<u>Enablement/Written Description Standard</u>**

The first paragraph of 35 U.S.C. 112 requires that the specification shall contain a written description of the invention, and of the manner and process of making and using it, so

as to enable any person skilled in the art to which it pertains to make and use the invention. To satisfy these written description requirement, a patent specification must describe the claimed invention in sufficient detail that one skilled in the art can reasonably conclude that the inventor had possession of the claimed invention. *See, e.g., Moba, B.V. v. Diamond Automation, Inc.*, 325 F.3d 1306, 1319, 66 USPQ2d 1429, 1438 (Fed. Cir. 2003). The test for enablement is whether one reasonably skilled in the art could make or use the invention from the disclosures in the patent coupled with information known in the art without undue experimentation. *See, e.g., United States v. Telectronics, Inc.*, 857 F.2d 778, 785, 8 USPQ2d 1217, 1223 (Fed. Cir. 1988).

Further, each claim limitation must be expressly, implicitly, or inherently supported in the originally-filed disclosure. *See, e.g., In re Wright*, 866 F.2d 422, 425, 9 USPQ2d 1649, 1651 (Fed. Cir. 1989). An applicant may show that an invention is complete by disclosure of sufficiently detailed, relevant identifying characteristics which provide evidence that applicant was in possession of the claimed invention, i.e., complete or partial structure, other physical and/or chemical properties, functional characteristics when coupled with a known or disclosed correlation between function and structure, or some combination of such characteristics. *See Enzo Biochem, Inc. v. Gen-Probe, Inc.*, 323 F.3d 956, 964, 63 USPQ2d 1609, 1613 (Fed. Cir. 2002). A description as filed is presumed to be adequate, unless or until sufficient evidence or reasoning to the contrary has been presented by the Examiner to rebut the presumption. *See, e.g., In re Marzocchi*, 439 F.2d 220, 224, 169 USPQ 367, 370 (CCPA 1971). The Examiner, therefore, must have a reasonable basis to challenge the adequacy of the written description and has the initial burden of presenting by a

preponderance of evidence why a person skilled in the art would not recognize in an applicant's disclosure a description of the invention defined by the claims. *See In re Wertheim*, 541 F.2d 257, 263, 191 USPQ 90, 97 (CCPA 1976). The requirements for sufficient disclosure of inventions involving computer programming are the same as for all inventions sought to be patented. *See* Manual of Patent Examining Procedure (MPEP) 2161.01.

B. <u>The Examiner has failed to establish that Appellant's specification contains insufficient written description to enable one of ordinary skill in the art to make and use the invention or to inform a person skilled in the art that Appellant was in possession of the claimed invention as a whole at the time the application was filed.</u>

The rejection of claims 12 and 30 under 35 U.S.C. 112, first paragraph, as failing to comply with the enablement requirement is hereby traversed. The Examiner suggests that there is no explanation for receiving a value of zero for p-est, an estimate of p based on a random sample, p, representing a probability that a randomly selected data value is in accordance with a selected criterion, F or steps relating to receiving δ or steps relating to receiving ε. Appellant traverses this conclusion. Appellant notes that δ is a confidence value and ε is an accuracy level, as noted above. Appellant also notes that the discussion of p-est begins on page 26, line 13 (p-est being the same as $\hat{p}$, an estimate of p based on a random sample) in connection with the use of a confidence value δ and an accuracy level ε. As described, p-est = 0 means that an observed number of error values exceeding prescribed

limits is zero. The description of Equations 6-9 in the specification (pages 21 to 23) detail the result of applying p-est = 0 using values of δ and ε that allow the determining of the equation for the number of random samples required (M). Appellant notes, in particular, that these directly refute the Examiner's comments on pages 5 and 6 suggesting there are no "formulas or algorithms" that would aid the Examiner's understanding the above-noted features.

Other comments of the Examiner on pages 5 and 6 may also be directly refuted. The Examiner suggests that "The prior art of verifying the accuracy of a neural network does not map to the current invention." To the extent Appellant understands this comment, Appellant discusses prior art use of a deterministic approach to verification, and identify how these approaches may not be as suitable as the randomized approach recited by Appellant. Other comments by the Examiner concerning "no specific level of predictability," "enormous experimentation," "no nature of the invention" with respect to receiving values for the processes recited by Appellant for a randomized approach to verifying accuracy of a component that is implemented from a model, suggest the Examiner's misunderstanding of the claimed invention and Appellant's disclosure. The steps of receiving the values for p-est, δ and ε in the context of determining the number of randomly selected data values (M) seem clear, and the receiving and use of these values are sufficiently described in connection with the equation for determining M and reflect a desired observed number of error values exceeding prescribed limits, a confidence value, an accuracy level, and would be understood by one of ordinary skill in the art.

Accordingly, in view of the above, Appellant respectfully requests that this rejection should be reconsidered and withdrawn. Further, to the extent a similar rejection as that set forth above, to claims 1 and 19 is maintained, the rejection having been previously applied to claims 1 and 19 in the prior Office Action but not restated in the Final Office Action, Appellant submits that the rejection of these claims should also be reversed.

The following rejections appeared in the First Office Action dated August 9, 2007, but were not included in the Final Office Action dated February 1, 2008. It is unclear to Appellant whether or not these rejections have been maintained. To the extent these rejections have been maintained and/or are the basis for any other rejections, Appellant traverses them for the reasons set forth below.

The previously-stated rejection of claims 1-4, 8, 12, 19-22, 26 and 30 under 35 U.S.C. 112, first paragraph, as being indefinite because of the use of a selected criterion F is hereby traversed. Appellant's selected criterion F is described in the specification (see, for example, beginning page 16, line 9 of the originally-filed specification) and recited in connection with a step of a method for determining if each of the randomly selected samples is not in accordance with said selected criterion, F. Appellant discloses examples of selected criterion F in the specification and as recited in the dependent claims. For example, dependent claim 4 recites that the selected criterion F is that e(x) evaluates to a value that exceeds predetermined bounds. Appellant submits that a step of determining if each of randomly selected samples is not in accordance with the selected criterion F is fully described and enabled by the specification and would be fully understood by one of ordinary skill in the art.

Accordingly, Appellant respectfully requests that the rejection, if presently maintained, be reversed.

The previously-stated rejection of claims 4 and 22 under 35 U.S.C. 112, first paragraph, as failing the written description requirement for lacking a definition in the specification of the functions e(x), f(x) and φ(x) is hereby traversed. As noted beginning on page 13, line 20, f(x) is a neural net trained to replace a known function φ(x) and, as noted beginning at page 16, line 1, e(x) is an error function defined by f(x) – φ(x). As defined in the claims, x is one of said points corresponding to one or more neural network inputs, where (for each point x, evaluated at f(x) and φ(x)), f(x) is a neural network output for a corresponding one of said points, and φ(x) is an expected output for a corresponding one of said points. Accordingly, an error function determination of e(x) is based on evaluating, for each point x, the neural net function f(x) and known function φ(x) that the neural net function is designed to replace, with the difference therebetween being the error function e(x). Appellant submits that the claimed terms are fully described and enabled by the specification and that one of ordinary skill in the art would understand and appreciate the claimed features. The term φ(x) is used for a known function, the term f(x) is used for a neural network function trained to model the known function, and the term e(x) is used for an error function for the difference between the known function and the neural net function. Accordingly, these terms are fully defined. To the extent the Examiner is suggesting that specific functions need to be identified, Appellant traverses this conclusion, noting that the features of a known function, a neural net function trained to model the known function and an error function for the difference therebetween are sufficiently defined in the specification and

claims. Appellant has used the terms φ(x) for the known function, f(x) for the neural net function and e(x) for the difference between the functions. Specific functional definitions beyond these definitions are not required, rather, these terms have been adequately defined as noted above. Accordingly, Appellant respectfully requests that this rejection, if presently maintained, be reversed.

CONCLUSION

In view of the above, it is respectfully requested that the Board reverse all of the Examiner's rejections under 35 U.S.C. 101 and 112.

Respectfully submitted,
MUIRHEAD AND SATURNELLI, LLC

Date: June 9, 2008

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CLAIMS APPENDIX

The claims on Appeal are as follows:

1. (Previously presented) A method for verifying accuracy of a component that is implemented from a model, comprising:

receiving a number of randomly selected samples, M, that result from at least one test of the component, for $M \geq \frac{1}{\varepsilon}\ln\left(\frac{1}{\delta}\right)$,

wherein

δ represents a confidence value in the range $0 < \delta < 1$,

ε represents an accuracy level of p-est to its true value p, in the range $0 < \varepsilon < 1$,

p represents a probability that a randomly selected point is in accordance with a selected criterion, F,

p-est, an estimate of p based on the M randomly selected samples, is zero,

and a probability that ($p \geq \varepsilon$) is equal to or less than δ;

determining if each of said randomly selected samples is not in accordance with said selected criterion, F; and

verifying accuracy of said component based on said determining.

2. (Original) The method of Claim 1, further comprising:

determining that said component is not verified as correct if any one of said selected samples is in accordance with said selected criterion F; and

determining that said component is verified as correct if all of said selected samples are not in accordance with said selected criterion, F.

3. (Previously presented) The method of Claim 2, wherein said samples are points, the selected criterion F uses a function f(x) where x is one of said points corresponding to one or more neural network inputs, f(x) is a neural network output for a corresponding one of said points, and said selected criterion F is that f(x) evaluates to a value that exceeds predetermined bounds.

4. (Previously presented) The method of Claim 2, wherein said samples are points, the selected criterion F uses an error function e(x) represented as:

$$e(x) = f(x) - \varphi(x)$$

where x is one of said points corresponding to one or more neural network inputs,

f(x) is a neural network output for a corresponding one of said points,

$\varphi(x)$ is an expected output for a corresponding one of said points, and

wherein said selected criterion F is that e(x) evaluates to a value that exceeds predetermined bounds.

5. (Original) The method of Claim 2, wherein said component is one of: a neural network, a fuzzy logic model, a fuzzy logic classifier, and a statistical k-neighbor classifier.

6. (Original) The method of Claim 2, wherein said component is included in a system with at least one other component.

7. (Original) The method of Claim 6, wherein said component is a first component, and an output of a second component is used as an input to the first component, and the method further comprising:

determining whether said first component is verified as correct in accordance with error that may be introduced by said second component's output.

8. (Previously presented) The method of Claim 6, wherein said component is a first component, and accuracy of a second component is verified using said M samples, said second component producing an output which is an input to a third component, and the method further comprising:

determining if each of said randomly selected samples is in accordance with said selected criterion, F for said second component; and

determining that said second component is verified as correct unless a predetermined number, b, of said selected samples are in accordance with said selected criterion F, b being equal to or greater than 1.

9. (Original) The method of Claim 2, wherein said component is included in a system of an aircraft being evaluated in accordance with a certification.

10. (Original) The method of Claim 9, wherein δ and ε are both equal to or less than 10^{-6}.

11. (Original) The method of Claim 10, wherein ε is equal to or less than 10^{-9}.

12. (Previously presented) A method for determining a number of randomly selected data values for verification of a component that is implemented from a model, comprising:

receiving a value of zero for p-est, an estimate of p based on a random sample, p representing a probability that a randomly selected data value is in accordance with a selected criterion, F;

receiving δ representing a confidence value in the range $0< \delta< 1$;

receiving ε representing an accuracy level of p-est to its true value p, in the range $0< \varepsilon < 1$, wherein a probability that $(p \geq \varepsilon)$ is equal to or less than δ; and

determining said number of randomly selected data values, M, that result from at least one test of the component and are used for verification of the component wherein M is determined in accordance with p-est=0, δ, and ε.

13. (Original) The method of Claim 12, wherein said component is a neural network.

14. (Original) The method of Claim 13, wherein said neural network is a feed forward static neural network.

15. (Original) The method of Claim 12, wherein M is determined according to one of: a Bernoulli analysis based on p-est=0 and a Bayesian analysis based on p-est=0.

16. (Original) The method of Claim 15, wherein M is determined according to said Bernoulli analysis and M is $M \geq \frac{1}{\varepsilon}\ln\left(\frac{1}{\delta}\right)$.

17. (Original) The method of Claim 15, wherein M is determined according to said Bayesian analysis with a non-informative prior distribution, and M is $M \geq \frac{1}{\varepsilon}\ln\left(\frac{1}{\delta}\right)$-1.

18. (Original) The method of Claim 15, wherein M is determined according to said Bayesian analysis using a family of parameterized prior probability density functions, and M is $M \geq \frac{1}{\varepsilon}\ln\left(\frac{1+\delta}{\delta}\right)$-1.

19. (Previously presented) A computer program product, stored on a computer-readable medium, that verifies accuracy of a component that is implemented from a model, the computer program product comprising code that:

receives a number of randomly selected samples, M, that result from at least one test of the component, for $M \geq \frac{1}{\varepsilon}\ln\left(\frac{1}{\delta}\right)$,

wherein

δ represents a confidence value in the range $0 < \delta < 1$,

ε represents an accuracy level of p-est to its true value p, in the range $0 < \varepsilon < 1$,

p represents a probability that a randomly selected point is in accordance with a selected criterion, F,

p-est, an estimate of p based on M randomly selected samples, is zero,

and a probability that ($p \geq \varepsilon$) is equal to or less than δ;

determines if each of said randomly selected samples is not in accordance with said selected criterion, F; and

verifies accuracy of said component based on whether each of said randomly selected samples is in not in accordance with said selected criterion F.

20. (Original) The computer program product of Claim 19, further comprising code that:

determines that said component is not verified as correct if any one of said selected samples is in accordance with said selected criterion F; and

determines that said component is verified as correct if all of said selected samples are not in accordance with said selected criterion, F.

21. (Previously presented) The computer program product of Claim 20, wherein said samples are points, the selected criterion F uses a function f(x) where x is one of said points corresponding to one or more neural network inputs, f(x) is a neural network output for a corresponding one of said points, and said selected criterion F is that f(x) evaluates to a value that exceeds predetermined bounds.

22. (Previously presented) The computer program product of Claim 20, wherein said samples are points, the selected criterion F uses an error function e(x) represented as:

$$e(x) = f(x) - \varphi(x)$$

where x is one of said points corresponding to one or more neural network inputs,

f(x) is a neural network output for a corresponding one of said points,

$\varphi(x)$ is an expected output for a corresponding one of said points, and

wherein said selected criterion F is that e(x) evaluates to a value that exceeds predetermined bounds.

23. (Original) The computer program product of Claim 20, wherein said component is one of: a neural network, a fuzzy logic model, a fuzzy logic classifier, and a statistical k-neighbor classifier.

24. (Original) The computer program product of Claim 20, wherein said component is included in a system with at least one other component.

25. (Original) The computer program product of Claim 24, wherein said component is a first component, and an output of a second component is used as an input to the first component, and the computer program product further comprising code that:

determines whether said first component is verified as correct in accordance with error that may be introduced by said second component's output.

26. (Previously presented) The computer program product of Claim 24, wherein said component is a first component, and accuracy of a second component is verified using said M samples, said second component producing an output which is an input to a third component, and the computer program product further comprising code that:

determines if each of said randomly selected samples is in accordance with said selected criterion, F for said second component; and

determines that said second component is verified as correct unless a predetermined number, b, of said selected samples are in accordance with said selected criterion F, b being equal to or greater than 1.

27. (Original) The computer program product of Claim 20, wherein said component is included in a system of an aircraft being evaluated in accordance with a certification.

28. (Original) The computer program product of Claim 27, wherein δ and ε are both equal to or less than 10^{-6}.

29. (Original) The computer program product of Claim 28, wherein ε is equal to or less than 10^{-9}.

30. (Previously presented) A computer program product, stored on a computer-readable medium, that determines a number of randomly selected data values for verification of a component that is implemented from a model, the computer program product comprising code that:

receives a value of zero for p-est, an estimate of a probability p based on a random sample, p representing a probability that a randomly selected data value is in accordance with a selected criterion, F;

receives δ representing a confidence value in the range $0< \delta< 1$;

receives ε representing an accuracy level of p-est to its true value p, in the range $0< \varepsilon < 1$, wherein a probability that $(p \geq \varepsilon)$ is equal to or less than δ; and

determines said number of randomly selected data values, M, that result from at least one test of the component and are used for verification of the component, wherein M is determined in accordance with p-est=0, δ, and ε.

31. (Original) The computer program product of Claim 30, wherein said component is a neural network.

32. (Original) The computer program product of Claim 31, wherein said neural network is a feed forward static neural network.

33. (Original) The computer program product of Claim 30, wherein M is determined according to one of: a Bernoulli analysis based on p-est=0 and a Bayesian analysis based on p-est=0.

34. (Original) The computer program product of Claim 33, wherein M is determined according to said Bernoulli analysis and M is $M \geq \frac{1}{\varepsilon}\ln\left(\frac{1}{\delta}\right)$.

35. (Original) The computer program product of Claim 33, wherein M is determined according to said Bayesian analysis with a non-informative prior distribution, and M is $M \geq \frac{1}{\varepsilon}\ln\left(\frac{1}{\delta}\right)$-1.

36. (Original) The computer program product of Claim 33, wherein M is determined according to said Bayesian analysis using a family of parameterized prior probability density functions, and M is $M \geq \frac{1}{\varepsilon}\ln\left(\frac{1+\delta}{\delta}\right)$-1.

EVIDENCE APPENDIX

None.

RELATED PROCEEDINGS APPENDIX

None.